RHODE ISLAND DEPARTMENT OF HEALTH

Office of Drinking Water Quality

2010

FROM THE DIRECTOR

Every time a water faucet is turned on and clean, safe drinking water is available, it is an example of public health's success. Ensuring that drinking water is clean and safe is one of the core functions of every public health department. The Rhode Island Department of Health's (HEALTH) Office of Drinking Water Quality is responsible for assuring that nearly 500 public water systems can deliver clean drinking water to more than one million Rhode Islanders, 24 hours a day, 7 days a week.

Safe drinking water does not happen on its own. It is a result of daily, sometimes hourly, partnership and collaboration. Every day, the team in the Office of Drinking Water Quality works with municipalities, state and federal agencies, and community programs that monitor and maintain water systems to prevent contamination of water supplies. When problems are identified, HEALTH's staff, along with individual water system personnel, identifies and corrects the problem so that clean water can be restored quickly and safely.

This annual report highlights some of HEALTH's achievements and accomplishments in 2010 and outlines some goals for the coming years. I invite you to learn about what we do and to join in our efforts to keep our state's drinking water clean and safe.

Michael Fine, MD
Director of Health

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INTRODUCTION

The U.S. Environmental Protection Agency (EPA) was created in 1970 to protect human health and the natural environment. In 1974, Congress passed the Safe Drinking Water Act in response to growing concerns over contamination of water supplies by agricultural and industrial chemicals. Major amendments to the Act were added in 1986 and 1996 that expanded the number of regulated contaminants, required cost-benefit analyses for future standards, supported public right-to-know, provided small water system support, and created loan funding programs for water infrastructure projects.

Current drinking water standards are the culmination of many years of industry regulatory oversight:

The Interstate Quarantine Act of 1893

- Intended to prevent the spread of disease
- Applied only to systems providing water to interstate travel (boats & trains)
- Enforced By United States Public Health Services (USPHS)

United States Environmental Protection Agency (US EPA) was established in 1970.

- 1974 - Safe Drinking Water Act (SDWA) enacted
- 1996 – Most recent amendments to the SDWA

Copies of this document are also available upon request in braille, large print, audiocassette, and as an electronic file on a computer disk. Contact the Rhode Island Department of Health, Office of Drinking Water Quality, Three Capitol Hill, Providence, RI 02908. Phone number: 401-222-6867, or Relay RI (TDD) at 711.

FROM OUR CHIEF

Unlike any other natural resource, water is necessary for basic life. Water is essential to virtually every human activity. We use it in the making of nearly every product we use, to grow our food, and to replenish every cell in our bodies through the water we drink.

The decisions we make today about diminishing resources, aging infrastructure, and treatment technologies will have an impact on our futures for years to come.

These basic tenets are woven into our every decision and activity. This office continues to partner with the U.S. EPA and the individual water systems that treat and deliver water to our businesses and households to ensure a safe supply of drinking water for all our potable needs.

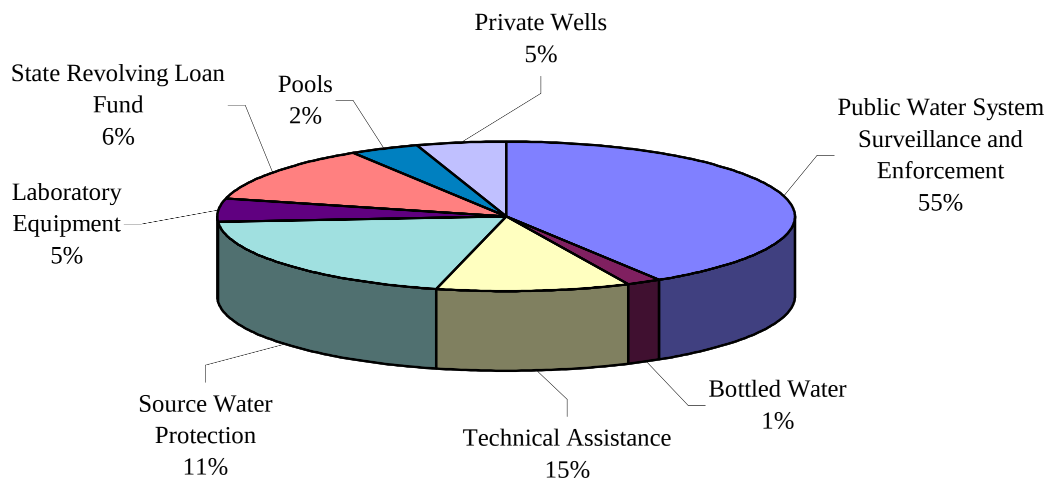
FINANCIALS

Program Budget

The average budget for this office during this period:

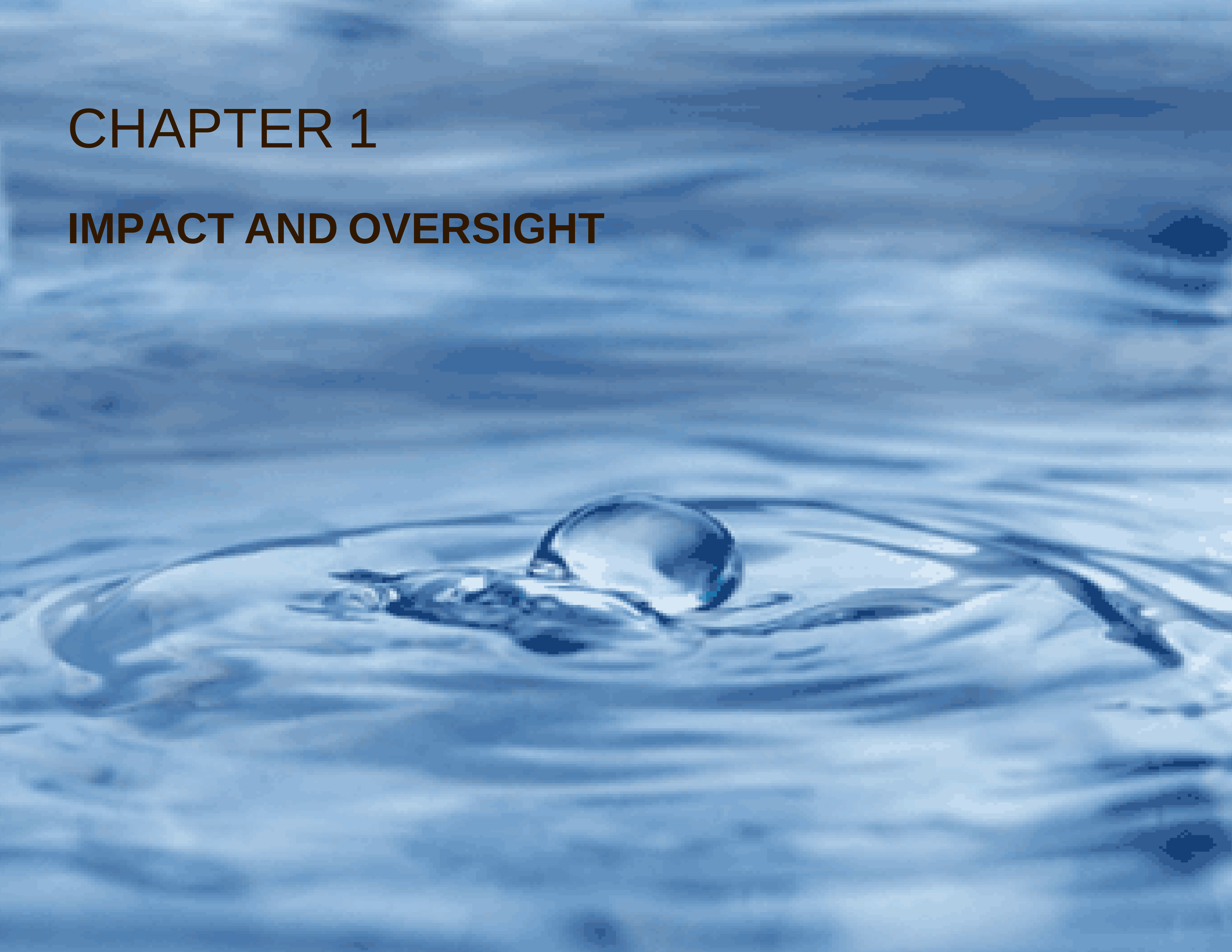
Federal Funding	$ 2,353,000
State Funding	350,000
Restricted Receipt	63,000
Total Budget	$2,766,000

Programs / Initiatives Supported by Funds



CHAPTER 1

IMPACT AND OVERSIGHT



The mission of the Public Drinking Water Program is to protect and promote the health and safety of the people of Rhode Island by ensuring the quality of the state's public drinking water supplies for use by Rhode Island residences, businesses, hospitals, nursing homes, schools, restaurants, industry, and fire and emergency response. The Office of Drinking Water Quality works hard to maintain an excellent record of meeting this high priority public health responsibility.

PUBLIC DRINKING WATER

HEALTH's Role

- Enforce federal and state drinking water regulations
- License and regulate public water systems
- Certify drinking water operators
- Inspect public water systems
- Sample and monitor water quality
- Training
- Administer the Drinking Water State Revolving Loan Fund
- Plan for emergencies, security, and counterterrorism
- Source water assessment
- Engineering reviews
- Capacity development

Persons served by public water in Rhode Island	*1,074,258
Persons served by surface water systems	*849,550
Persons served by groundwater systems	*224,708
Public water systems	490
Community systems	89
Non-transient systems	81
Transient systems	317
Systems using surface water	29
Systems using groundwater	**459

*Includes all populations, transient, residential, and workplace.

**Some water systems use both ground and surface water (purchased and non-purchased).

Public water systems in Rhode Island range in size from large city systems that serve nearly 300,000 residents to small, rural, non-community transient systems, such as restaurants or convenience stores that utilize wells as their drinking water source.

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TYPES OF PUBLIC WATER SYSTEMS

A **public water system** provides piped water to the public for human consumption. A public system has at least 15 service connections or regularly serves an average of 25 individuals daily for at least 60 days out of the year.

Community *water systems serve at least 25 year-round residents, or have at least 15 service connections used by year-round residents.*

Non-transient non-community *water systems serve at least 25 of THE SAME people, for at least six months of the year. Schools and factories are examples.*

Transient non-community *water systems serve at least 25 DIFFERENT people for at least 60 days of the year. Restaurants, hotels and campgrounds are transient water suppliers.*

The Private Well Program is 100% federally funded and is the only source of public health information for more than 100,000 citizens and tourists who rely on private water systems for their drinking water. This program is critical to assuring safe and potable water supplies through the education of private well owners, state and local officials, and other involved parties on the proper construction, maintenance, operation, and testing of their wells.

PRIVATE DRINKING WATER

Within HEALTH, the Office of Private Well Water Contamination ensures that required well testing is carried out per regulation and that the well-owning public is educated as to what testing is recommended for routine maintenance of their wells. HEALTH has partnered with the Rhode Island Department of Environmental Management and the University of Rhode Island Cooperative Extension Water Quality Program since 1993.

2010 Program Highlights

Provided educational programs and resources to municipal officials and private well owners to protect and maintain drinking water sources.

Developed and distributed fact sheets, technical bulletins, displays and other educational materials.

Updated and expanded the project website as a resource center for source water protection.

Scheduled and set up two private well educational displays. Typically, the displays travel to area town halls and libraries throughout the state one month prior to a workshop being held in the area.

Assures public health and safety of public pools and spas through licensing, design approval, inspection, sampling, and complaint response.

PUBLIC POOLS AND SPAS

HEALTH ensures that public swimming pools are constructed and operated in a safe and sanitary manner. Inspections of the filtering system, water quality, and other sanitary and safety concerns are performed routinely.

In 2010 HEALTH licensed 441 public pools. Yearly (indoor) pools are licensed to operate from January 1 through December 31 of the year issued. Seasonal (outdoor) pools are licensed from June 1 through September 30 of the year issued. Compliance data for the Public Pools and Spas Program is included in Appendix - III (page 42).

Licensed Public Pools 2010			
Swimming Pools		Therapy Pools (Hot Tubs)	
Yearly	Seasonal	Yearly	Seasonal
118	236	71	16
Total licensed public pools 441			

This program assures public health and safety of bottled drinking water through licensing, approvals inspections, sampling, and complaint response. Risks to the general public caused by bottled water can include contracting waterborne illness due to poor source water quality, treatment, or bottling processes. HEALTH oversight greatly reduces these risks.

BOTTLED WATER

HEALTH's Role

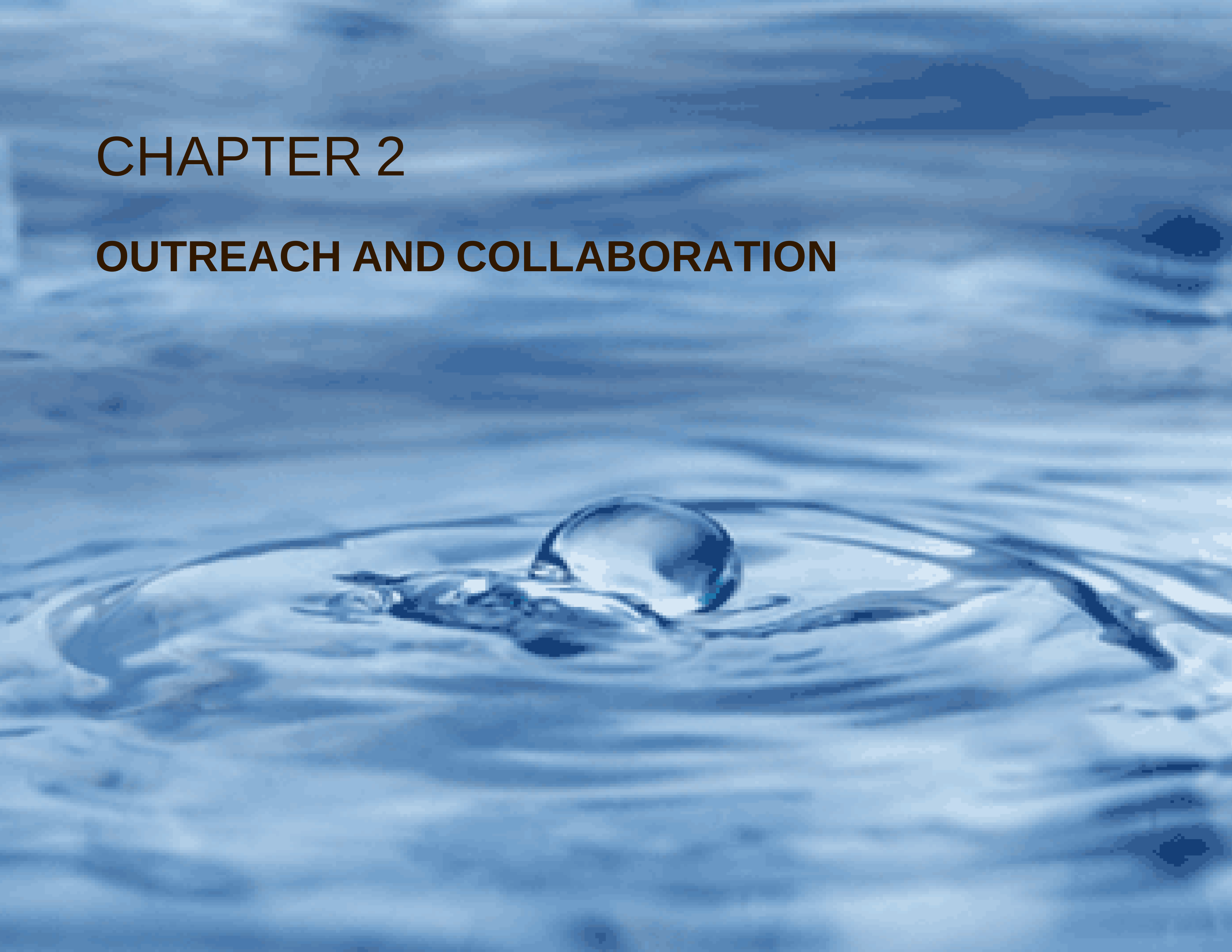
- Licensure of both in and out of state operations
- Inspections
- Water quality sampling
- Water quality data review
- Source approval for in-state operations
- Response to water quality/health issues

Bottled water is an increasingly popular beverage. More than 8.5 billion gallons are sold annually in the United States. The U.S. Food and Drug Administration (FDA) regulate bottled water as a food product. Under the Federal Food, Drug, and Cosmetic Act (FFDCA), manufacturers are responsible for producing safe, wholesome and truthfully labeled food products, including bottled water products. The FDA has established specific regulations for bottled water including standard of identity regulations that define bottled water as "water that is intended for human consumption and that is sealed in bottles or other containers with no added ingredients except that it may optionally contain safe and suitable antimicrobial agents".

Bottled water may come from several sources: artesian well water, public water systems, mineral water, purified water, sparkling water, or spring water. Prerequisites for obtaining a bottling permit are: submittal and approval of analytical data for the water source and product, label approval, satisfactory inspection reports, and approval of the permit application. Compliance data for the bottled water program is included in Appendix - IV (page 43).

CHAPTER 2

OUTREACH AND COLLABORATION



CAPACITY DEVELOPMENT

The 1996 amendments to the Safe Drinking Water Act (SDWA) include provisions for capacity development. The EPA, states, and public water systems work together to ensure that public water systems attain and maintain the technical, managerial, and financial capacities that contribute to the viability of sustainable water utilities.

DEVELOPING CAPACITY

Rhode Island's public drinking water systems face a wide array of challenges in meeting the public health protection standards aimed at ensuring safe drinking water.

The state's capacity development strategy identifies water systems that have inadequate technical, managerial, and financial capacity. Once identified, our focus is on developing and implementing strategies that provide system personnel with the tools and knowledge that effectively improve personnel capacities increasing the system's potential for sustainability

HEALTH maintains various contracts with industry professionals and organizations to provide wide-ranging services to the owners and operators of public water systems. In 2010, HEALTH partnered with the Atlantic States Rural Water and Wastewater Association, New England Water Works Association, The University of Rhode Island Cooperative Extension, Horsley Witten Group, and The Louis Berger Group, Inc.

2010 Highlights

- Technical assistance and one-on-one consultant program for small water systems serving populations of 3,300 or less
- Assistance with production of consumer confidence reports
- Water system management guides

OPERATOR CERTIFICATION

Ensuring a competent workforce is a key element in the protection of public health and the provision of safe drinking water. Individuals who operate public water supply treatment and distribution systems must be certified and licensed by HEALTH. Once licensed, operators adhere to continuing education and experience requirements prior to license renewal or upgrade. There are 493 licensed and certified treatment and distribution operators in the state.

CERTIFICATION & TRAINING

There are 169 Rhode Island public water systems that are required to comply with the state's operator certification regulations. A Board of seven persons, comprised of the Director of HEALTH, (or his designee) and six members appointed by the Governor oversee the program. The Board meets quarterly and is responsible for review and/or updates to the regulations [R23-65-DWQ]; reviewing and approving applications for certification exams and license renewal; and disciplinary actions against licensees as necessary.

In collaboration with the Capacity Development, Drinking Water State Revolving Loan Fund, and Emergency Planning programs, the Operator Certification program offered operators a variety of training and professional development opportunities in 2010. Together we offered:

- Individual and group training and operator certification assistance for the state's 493 certified operators,
- A training course voucher program through New England Water Works Association,
- Incident Command System training and certification,
- National Incident Management System training, and
- Cross-connection control training and certification.

EMERGENCY PLANNING AND SECURITY

A secure water sector is critical to protecting public health and ensuring public confidence. Through this office, HEALTH's Water System Security and Emergency Preparedness Program is responsible for helping drinking water systems develop plans to better respond to potential disasters or emergencies.

Safety & Security

Public water and power sectors share many of the same vulnerabilities, such as natural and manmade disasters, pandemics, and terrorism. However, water distribution networks are more resistant to the effects of weather. During severe storms or other events resulting in a loss of power, water systems may need to rely on auxiliary power units to maintain critical operations for several days or weeks.

HEALTH is currently completing a public water system backup generator survey. This project provides an extensive review of the backup power generation capabilities of the drinking water facilities in the state.

The project goal is to provide the support needed at the state level to ensure an uninterrupted supply of potable water for our citizens during emergencies, disasters, and other natural or manmade crises.
Project outcomes will be used to determine the need for modifications to the *Rules and Regulations Pertaining to Public Drinking Water [R46-13-DWQ]*.

Also during 2010, HEALTH sponsored four tabletop exercises for the owners and operators of public water systems. Those exercises focused on continued development and understanding between utility personnel and first responders (fire, police, EMS, 911 dispatchers and emergency management personnel) during emergencies.

Cross-connection control is a part of the HEALTH office of DWQ water security and protection effort. While most backflow incidents are accidental, an unprotected water system is also vulnerable to intentional contamination through cross-connections. HEALTH contracted with Weston & Sampson, Inc. to complete a model cross-connection control plan template, brochure and technical assistance program.

DRINKING WATER STATE REVOLVING LOAN FUND

The Safe Drinking Water Act Amendments of 1996 authorized the creation of a Drinking Water State Revolving Loan Fund (DWSRF) program to help public water systems finance the costs of infrastructure needed to achieve and/or maintain compliance with SDWA requirements and to meet the public health objectives of the act.

IMPROVING SUSTAINABILITY

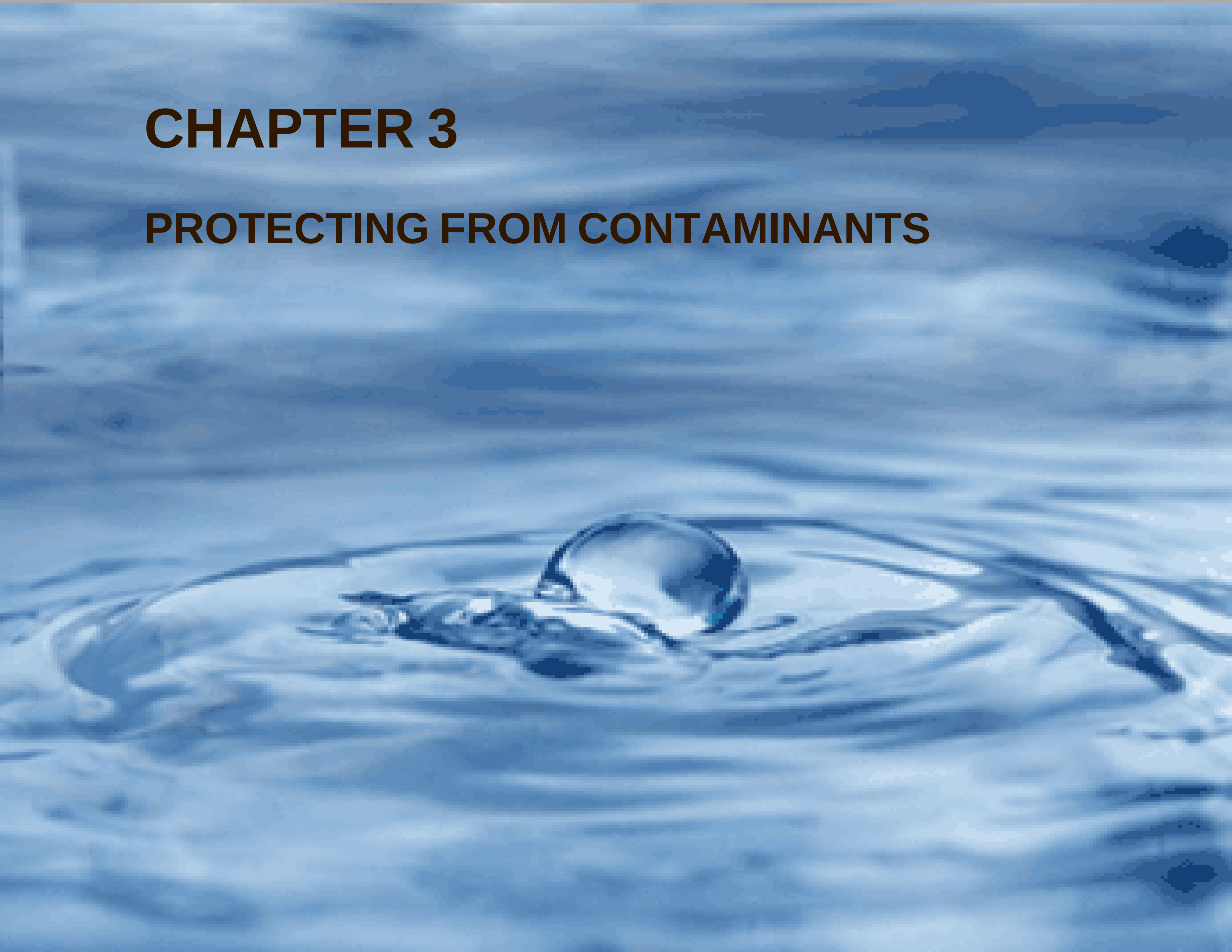
Our office, in conjunction with the Rhode Island Clean Water Finance Agency (RICWFA), operates the DWSRF program with funds awarded through an annual EPA capitalization grant. Among the many program functions, staff is responsible for compilation of an infrastructure project priority list; environmental review of proposed projects; oversight of construction; and loan payment review. Capacity development and operator certification are key loan program qualification components and are reviewed during the application process.

During the state fiscal year 2010, (July 1, 2009 – June 30, 2010) no new loans were made under the DWSRF base program. During that time, the state turned its focus to executing loans made with American Recovery and Reinvestment Act (ARRA) appropriations. All loans made with ARRA funding met the loan execution deadline of February 17, 2010.

The FY10 Program Evaluation Report completed by EPA determined that the State far exceeded the required level of binding commitments by $131,098,197 and is in compliance with program requirements.

CHAPTER 3

PROTECTING FROM CONTAMINANTS



WATER QUALITY MONITORING & TREATMENT

There are many sources for water pollution. Contamination of drinking water can occur at multiple points, including in the water source, through inadequate water treatment processes, in storage tanks, and in distribution systems (the pipes that carry water to homes, businesses, schools, and other buildings). Treating water to remove or kill disease-causing contaminants is critical to the protection of public health.

Maximum Contaminant Levels

Under the Safe Drinking Water Act (SDWA), EPA sets maximum legal limits on the levels of certain contaminants in drinking water (MCL). The legal limits reflect both the level that protects human health and the level that water systems can achieve using the best available technology.

EPA rules also set treatment requirements, water-testing schedules and methods that water systems must follow.

HEALTH is the agency responsible for ensuring that the water systems in Rhode Island comply with these rules. Compliance Data for 2010 is included in Appendix-II (page 30).

Chemical Contaminant Rules

Chemical Contaminants were regulated in phases, which are collectively referred to as the Chemical Phase Rules. HEALTH regulates more than 90 contaminants in three contaminant groups: Inorganic Contaminants (IOCs), Volatile Organic Contaminants (VOCs), and Synthetic Organic Contaminants (SOCs). A list of contaminants and their maximum contaminant levels (MCLs), is maintained on line at http://water.epa.gov/drink/contaminants/index.cfm . The rules apply to all public water systems (PWS). PWS type, size, and water source determine which contaminants require monitoring for that system.

Radionuclides

Most drinking water sources have very low levels of radioactive contaminants ("radionuclides"), most of which are naturally occurring, although contamination of drinking water sources from human-made nuclear materials can also occur.

WATER QUALITY MONITORING & TREATMENT

Arsenic

Arsenic is a semi-metal element in the periodic table. It is odorless and tasteless. It enters drinking water supplies from natural deposits in the earth or from agricultural and industrial practices.

Total Coliform

There are a variety of bacteria, parasites, and viruses which can cause health problems when humans ingest them in drinking water. Testing water for each of these germs would be difficult and expensive. Instead, water quality and public health workers measure for the presence of bacteria in drinking water using coliform bacteria as an indicator. The presence of any coliforms in drinking water suggests that there may be disease-causing agents in the water.

Disinfectants and Disinfection Byproducts (DBPs)

In many cases, source water from a lake, river, reservoir or ground water aquifer needs to be disinfected to inactivate (or kill) microbial pathogens. A major challenge for water suppliers is how to balance the risks from microbial pathogens and disinfection byproducts. In 2010 there were 28 water systems regulated by this rule. There were also 16 systems that purchase and distribute water that has been treated with a disinfectant. These systems currently monitor the residual chlorine levels throughout their distribution systems. Beginning in 2012 they will also monitor levels of DBPs.

TREATMENT RULES

Ground Water Rule

The purpose of the rule is to reduce disease incidence associated with disease-causing microorganisms in drinking water. The rule establishes a risk-based approach to target ground water systems that are vulnerable to fecal contamination. Ground water systems that are identified as being at risk of fecal contamination must take corrective action to reduce potential illness from exposure to microbial pathogens. The rule applies to all systems that use ground water as a source of drinking water.

Surface Water Treatment Rules (SWTR)

These rules establish filtration and disinfection treatment requirements for the control of pathogens for all public water supplies that utilize surface water sources or ground water sources that are under the influence of surface water. In Rhode Island there are 10 water systems that are covered by these rules. All of these water systems provide filtration and disinfection as part of their treatment processes. The SWTR requires an additional 15 systems that are secondary sellers of surface water to maintain a chlorine residual throughout their distribution system.

Lead & Copper Rule

The Lead and Copper Rule is intended to minimize the corrosivity of water provided by community and non-transient non-community water systems. Lead and copper enter drinking water primarily through plumbing materials. The treatment technique requires systems to monitor drinking water at customer taps. Excessively corrosive water triggers a requirement for a treatment proposal, public education, and if applicable, lead service line replacement.

Nine small water systems are currently exceeding either the lead or copper action level. Of these, two systems are connecting to neighboring suppliers, and one is re-plumbing in plastic. Four systems must propose treatment within 12 months to be in compliance with the rule, and two are adjusting existing treatment.

Providence Water has been exceeding the lead action level since 2006, and has since been aggressively replacing service lines. HEALTH conducted a study of the effect of partial lead service line replacement on total lead at the tap in the City of Cranston. The process of partial replacement had become controversial because a study done in Washington, DC, showed no improvement in children's blood lead levels in homes where such work was done. However, our study showed a consistent decline in lead at the tap, and a much shorter flushing time required to clear stagnant, lead-bearing water from household plumbing, after the city-owned sections of pipe had been replaced with copper. A project summary report titled "The Effect of Partial Lead Service Line Replacement on Total Lead at the Tap" is included in Appendix – V (page 44).

WATER QUALITY SAMPLING AND TESTING

Water quality sampling and testing not only ensures that each system complies with required monitoring, but more importantly, ensures the quality of the state's drinking water.

HEALTH's laboratory continues to take an active role in assisting water systems with required water quality testing. During 2010, HEALTH's laboratory analyzed 4,813 samples. The Office of DWQ evaluated 33,681 samples.

HEALTH also accepts water quality data from certified environmental laboratories on behalf of public water suppliers. The E2 web-based system provides an alternative to submitting handwritten or paper-based reports. All of the necessary legal, security, and electronic signature functions are included to provide for completely paperless reporting.

A broad spectrum of environmental tests and analyses are provided to public water systems.

HEALTH'S Role

- Test drinking water from Rhode Island public water systems for organic and inorganic contaminants, minerals, and trace metals to determine safety and compliance with the Safe Drinking Water Act
- Test potability of water from private wells
- Analyze water samples in support of special pollution monitoring programs
- Maintain analytical instrumentation to detect and measure the concentration of a variety of pesticides, volatile and synthetic organic pollutants in drinking water
- Ensure the high quality of testing services
- Operate the analytical laboratory certification program
- Maintain a list of laboratories certified for the analysis of drinking water, non-potable water and environmental lead

CHAPTER 4

PERFORMANCE AND COMPLIANCE

INSPECTIONS AND SITE VISITS

All aspects of a public water system (water source, treatment facility, operation and maintenance) need periodic inspection to assure that the water system continues to supply safe drinking water to the public.

WATER SYSTEM INSPECTIONS

During 2010, HEALTH's, DWQ staff conducted sanitary survey inspections as listed in the detailed chart provided. Follow-up sanitary survey inspections were required at a majority of these facilities to ensure that any deficiencies had been satisfactorily addressed. Additional inspections were conducted in direct response to requests for technical assistance from water systems. Survey personnel also performed compliance inspections of new construction or significant improvements in water system infrastructure.

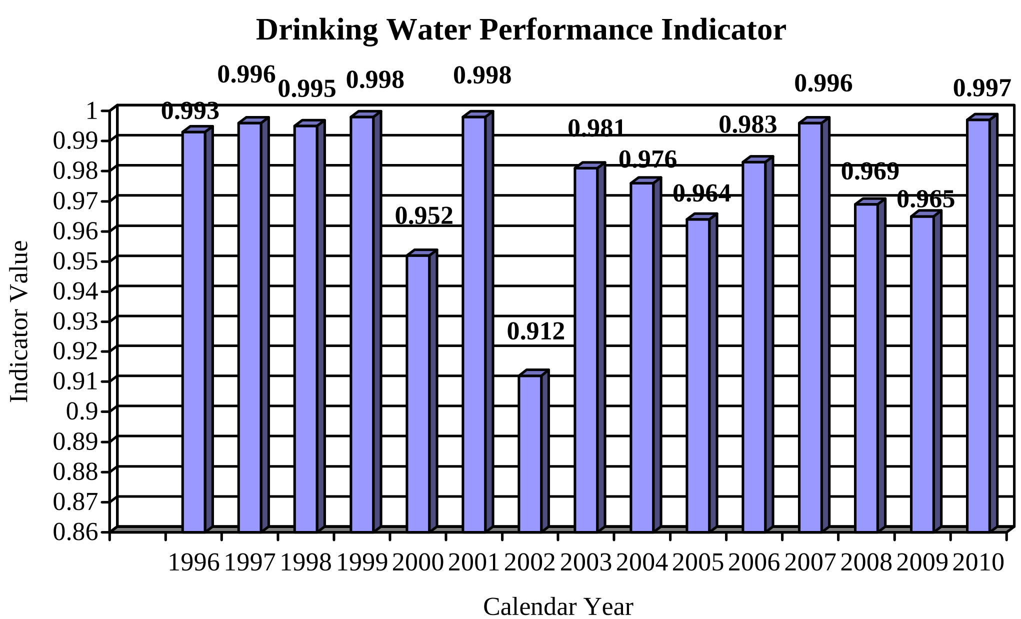
Water System Inspections	2010
Total number of Water systems inspected	127
Total population served	782,821
Number of community systems inspected	34
Population served	760,180
Number of transient Non-community systems Inspected	76
Population Served	11,671
Number of Non-transient, non-community systems inspected	17
Population Served	10,970

PERFORMANCE REVIEW

Of all the requirements with which water systems are expected to comply, the most important is that of meeting minimum health standards. Each year, HEALTH evaluates the progress of the State's individual water systems as well as Rhode Island's Drinking Water Program in meeting these minimum health standards.

PERFORMANCE REVIEW

In making this evaluation, HEALTH uses a "performance indicator value," based on compliance with the Safe Drinking Water Act requirements for the entire year. The indicator value, shown to the right, is based on compliance with maximum contaminant levels (MCLs) and treatment technique requirements. Violations related to public education/public notice and monitoring errors are not included in this indicator. To make the indicator more representative of the state's drinking water quality, it is weighted by the number of days the system operated in compliance, the size of the population served by the water system, and the total number of days that the system was actually in operation. An indicator value of 1.0 would mean that all public water systems were in compliance with every MCL and treatment technique requirement for the entire year.



$$\text{Indicator Value} = \frac{\Sigma\,(\text{PWS Population Served}) \times (\text{Days in Compliance With MCLs and Treatment Technique Requirements})}{\Sigma\,(\text{PWS Population Served}) \times (\text{Total Days in Operation})}$$

COMPLIANCE

Compliance data is included herein for calendar year 2010. The 2010 Annual Compliance Report summary table, as required by the Safe Drinking Water Act amendments of 1996, can be found in Appendix – II (page 30).

During calendar year 2010, 168 violations of the Safe Drinking Water Act were reported by 134 of the State's public water systems. Of these 168 violations, 66 were water quality violations, 95 were monitoring violations, one was for failure to report a coliform positive result, and six were Public Notification violations. A summary of the violations is presented in Appendix – I (page 25).

Quality Violations

Quality violations occur when the monitoring results for a particular contaminant exceed the drinking water standard within a specific time period. Public water systems must monitor for 90 contaminants including inorganic compounds, volatile organic compounds, synthetic organic compounds, radionuclides, and pathogens.

During 2010, 44 of the public systems exceeded a drinking water standard for a total of 66 violations. Of those 66 violations, 55 were bacteriological violations, one was for nitrate, three were for beryllium, two for chlorine dioxide, and five were for radionuclides.

Monitoring Violations

Monitoring violations occur when a water system fails to perform the required monitoring for a particular contaminant within a specified time period. During 2010, 82 of the state's water systems failed to perform the required monitoring within the specified time period. In all, 95 monitoring violations were reported.

Reporting Violations

Reporting violations occur when a water system fails to perform the required reporting within a specified time period. During 2010, seven of the state's water systems failed to perform the required reporting within the specified time period. Six water systems failed to perform Public Notice and one water system failed to report a positive coliform result within 24 hours.

Treatment Technique Violations

Treatment Technique violations occur when a water system fails to comply with the required treatment. During 2010, three of the state's water systems remained out of compliance by failing to install corrosion control treatment within the specified time period. E. Searles Ball Memorial Housing is connecting to Block Island Water, Paige Associates is installing corrosion control, and Coventry Air National Guard has transferred to the Army and is acting to correct the problem.

VIOLATIONS 2010

COMMUNITY WATER SYSTEMS

	NUMBER OF VIOLATIONS
Quality:	
BRISTOL COUNTY WATER AUTHORITY (ClO_2)	2
HEBERT NURSING HOME, INC. (RAD)	1
HILLSDALE HOUSING COOPERATIVE, INC. (Be)	3
HILLSDALE HOUSING COOPERATIVE, INC. (RAD)	1
LAWRENCE SUNSET COVE ASSOCIATION (TCR)	4
LINDHBROOK WATER COMPANY (TCR)	3
MEADOWLARK, INC.(TCR)	3
PRUDENCE ISLAND WATER DISTRICT (TCR)	3
RICHMOND WATER SUPPLY BOARD (TCR)	1
SHADY ACRES, INC. (RAD)	4
UNITED WATER RHODE ISLAND (TCR)	1
Monitoring:	
BETHEL VILLAGE WATER ASSN (TCR)	1
BRISTOL COUNTY WATER AUTHORITY (LCR)	1
GREENVILLE WATER DISTRICT (LCR)	1
HILLSDALE HOUSING COOPERATIVE, INC. (LCR)	1
LAWRENCE SUNSET COVE ASSOCIATION (TCR)	5
LAWRENCE SUNSET COVE ASSOCIATION (VOC)	1
MOHEGAN WATER ASSOCIATION, INC. (LCR)	1
PASCOAG UTILITY DISTRICT, WATER DIVISION (LCR)	1
PRUDENCE ISLAND WATER DISTRICT (TCR)	1
UNITED STATES NAVY (FORT ADAMS) (TCR)	1
WARWICK-CITY OF (TCR)	1
WARWICK-POTOWOMUT (TCR)	1
WOODPECKER HILL NURSING HOME (LCR)	1
Public Notification:	
INDIAN CEDAR MOBILE HOME PARK	1
MEADOWLARK, INC.	1
MOBILE VILLAGE, INC.	1
SPLIT ROCK	1
COMMUNITY WATER SYSTEM, SUBTOTAL	47

NON-COMMUNITY NON-TRANSIENT WATER SYSTEMS

VIOLATIONS 2010

	NUMBER OF VIOLATIONS
Quality:	
EXETER-W. GREENWICH JR/SR HIGH SCHOOL (TCR)	2
METCALF ELEMENTARY SCHOOL (TCR)	1
NORTH SMITHFIELD 282 COMBAT COMMUNICATIONS TCR)	2
PONAGANSETT HIGH SCHOOL (TCR)	2
SILVEIRA KINDERGARTEN & NURSERY SCHOOL (NO3)	1
WRIGHTS FARM CORP. (TCR)	1
Monitoring:	
COVENTRY AIR NATIONAL GUARD (TCR)	1
COVENTRY AIR NATIONAL GUARD (LCR)	3
COVENTRY AIR NATIONAL GUARD (VOC)	1
EARLY LEARNING CENTER (LCR)	1
EXETER-W. GREENWICH JR/SR HIGH SCHOOL (GWR)	1
WRIGHTS FARM CORP. (GWR)	1
Public Notification:	
COVENTRY AIR NATIONAL GUARD	1
WEST GREENWICH TOWN HALL	1
NON-COMMUNITY NON-TRANSIENT WATER SYSTEM SUBTOTAL	19

VIOLATIONS 2010

Quality:	Number of Violations
ABRAHAM MANCHESTER RESTAURANT & TAVERN (TCR)	1
ANDREWS REALTY, INC. DBA RICHMOND PLAZA (TCR)	1
BRIGGS BEACH, INC (TCR)	1
CADYS TAVERN (TCR)	1
COMMONS LUNCH, INC. (TCR)	1
COUNTRY VIEW GOLF CLUB (TCR)	2
DORRS TAVERN LLC (TCR)	1
FOSTER COUNTRY CLUB INC. (FRIEL GOLF CO) (TCR)	1
FROSTY DREW NATURE CENTER-NINIGRET PARK (TCR)	1
LINCOLN WOODS STATE PARK, SOUTH BEACH (TCR)	1
LITTLE COUNTRY PIZZA (TCR)	1
MINISTERS LOT HOMEOWNERS ASSOC. (TCR)	2
RHODE ISLAND WELCOME CENTER (TCR)	1
RI COMMUNITY LIVING & SUPPORT (LADD) (TCR)	1
RIS ONLY 24 HR. TRUCK/AUTO PLAZA,INC. (TCR)	2
SACHUEST POINT NATL WILDLIFE REFUGE (TCR)	1
ST. THERESA OF THE CHILD JESUS CHURCH (TCR)	2
SUMMIT GENERAL STORE, LTD. (TCR)	1
THE COVE (TCR)	2
THE SULLIVAN HOUSE (TCR)	2
TOWNSMEN CLUB, INC. (TCR)	2
TUFFYS, INC. (TCR)	1
WEST KINGSTON PARK (TCR)	2
WOODLAND MEETING HOUSE (TCR)	1

VIOLATIONS 2010

Monitoring:	Number of Violations
ANDREWS REALTY, INC. DBA RICHMOND PLAZA (GWR)	1
ANDREWS REALTY, INC. DBA RICHMOND PLAZA (TCR)	1
BIG RIVER INN (TCR)	2
BLOCK ISLAND AIRPORT OPERATIONS (GWR)	1
BLOCK ISLAND AIRPORT OPERATIONS (TCR)	1
BRANTALS RESTAURANT AND CATERING (TCR)	1
CADYS TAVERN (TCR)	1
CADYS TAVERN (GWR)	1
CAMP RUSSELL-PUMP HOUSE MALLARD SHORES (TCR)	1
COVENTRY MENS CLUB, INC. (TCR)	1
COVENTRY MENS CLUB, INC. (GWR)	1
D. B. MART #9 (TCR)	1
D. B. MART #9 (GWR)	1
DORRS TAVERN LLC (GWR)	1
EXETER COUNTRY CLUB, INC. (NO3)	1
FANTASTIC UMBRELLA FACTORY (TCR)	1
FIRST SEVENTH DAY BAPTIST CHURCH OF HOPKINTON (TCR)	1
FOSTER COUNTRY CLUB INC. (FRIEL GOLF CO) (TCR)	1
FOUR CORNERS GRILL (TCR)	1
FUN IN THE SUN ENTERPRISE, INC. DBA MR. DOUGHBOY (TCR)	1
GLAD TIDINGS COMMUNITY CHURCH (TCR)	1
HIGHVIEW INN (TCR)	2
HIGHVIEW INN (GWR)	1
HOLIDAY ACRES, INC. (TCR)	1
JOHNSTON RECREATION ATHLETIC FIELDS (TCR)	1
KINGSTON PIZZA OF NARRAGANSETT, INC. (TCR)	1
MICHAELS SHELL STATION (TCR)	1
MICHAELS SHELL STATION (GWR)	1
MIDDLETOWN FOP LODGE 21 (TCR)	1
MINISTERS LOT HOMEOWNERS ASSOC. (TCR)	2
NARRAGANSETT INN (TCR)	1
NATIONAL DOMESTIC PREPAREDNESS COALITION (TCR)	2
NATIONAL DOMESTIC PREPAREDNESS COALITION (GWR)	1

VIOLATIONS 2010

	Number of Violations
NEIGHBORHOOD VARIETY (TCR)	1
NEW ENGLAND FARMS (TCR)	1
NEWPORT BOYS & GIRLS CLUB CAMP (TCR)	1
NORMAN A & PAMELA MACHON DBA SOPHIES COFFEE (TCR)	2
NORTH SMITHFIELD FLY FISHING (GWR)	1
OLD VICTORY SQUARE DINER (TCR)	1
PINECREST GOLF COURSE, INC. (TCR)	1
PINEWOOD PARK (TCR)	1
RICHMOND COUNTRY CLUB, INC (TCR).	1
ROCCOS (TCR)	1
SACHUEST POINT NATL WILDLIFE REFUGE (TCR)	1
SACHUEST POINT NATL WILDLIFE REFUGE (GWR)	1
SAKONNET GOLF CLUB (NO3)	1
STICKS TAVERN (PUTNAM PROPERTIES) (TCR)	1
STONE HOUSE MOTOR INN (TCR)	1
THE COVE (TCR)	2
THE HITCHING POST, INC. (NO3)	1
TOWNSMEN CLUB, INC. (TCR)	2
US FISH AND WILDLIFE SERVICE VISITOR CTR (TCR)	1
VFW POST 6342 (TCR)	2
W. ALTON JONES CAMPUS - ENVIRONMENTAL ED (TCR)	1
W. ALTON JONES CAMPUS - URI - RESEARCH B (TCR)	1
W. ALTON JONES CAMPUS - URI POOR FARM (TCR)	1
W. ALTON JONES CAMPUS-URI-WHISPERING PINES (TCR)	1
W.ALTON JONES CAMPUS-MAIN OFF-FARM HOUSE (TCR)	1
WINDMILL HILL GOLF COURSE, INC. (TCR)	1
WOLF ROCK COUNTRY KITCHEN, INC. (TCR)	1
YMCA CAMP FULLER (TCR)	1
Public Notification:	
ANDREWS REALTY, INC.	1
TRANSIENT WATER SYSTEM SUBTOTAL	102

TRANSIENT WATER SYSTEMS (CONTINUED)

APPENDIX II

Compliance Table

State: Rhode Island

Reporting Interval: January 1, 2010 through December 31, 2010

SDWIS Codes		MCL (mg/l)	MCLs		Treatment Techniques		Significant Monitoring/Reporting	
			Number of Violations	Number of Systems With Violations	Number of Violations	Number of Systems With Violations	Number of Violations	Number of Systems With Violations
	Organic Contaminants							
2981	1,1,1-Trichloroethane	0.2	0	0			2	2
2977	1,1-Dichloroethylene	0.007	0	0			2	2
2985	1,1,2-Trichloroethane	.005	0	0			2	2
2378	1,2,4-Trichlorobenzene	.07	0	0			2	2
2931	1,2-Dibromo-3-chloropropane (DBCP)	0.0002	0	0			0	0
2980	1,2-Dichloroethane	0.005	0	0			2	2
2983	1,2-Dichloropropane	0.005	0	0			2	2
2063	2,3,7,8-TCDD (Dioxin)	$3x10^{-8}$	0	0			0	0
2110	2,4,5-TP	0.05	0	0			0	0
2105	2,4-D	0.07	0	0			0	0
2051	Alachlor	0.002	0	0			0	0

State: Rhode Island

Reporting Interval: January 1, 2010 through December 31, 2010

SDWIS Codes		MCL (mg/l)	MCLs		Treatment Techniques		Significant Monitoring/Reporting	
			Number of Violations	Number of Systems With Violations	Number of Violations	Number of Systems With Violations	Number of Violations	Number of Systems With Violations
2050	Atrazine	0.003	0	0			0	0
2990	Benzene	0.005	0	0			2	2
2306	Benzo[a]pyrene	0.0002	0	0			0	0
2046	Carbofuran	0.04	0	0			0	0
2982	Carbon tetrachloride	0.005	0	0			2	2
2959	Chlordane	0.002	0	0			0	0
2380	cis-1,2-Dichloroethylene	0.07	0	0			2	2
2031	Dalapon	0.2	0	0			0	0
2035	Di(2-ethylhexyl)adipate	0.4	0	0			0	0
2039	Di(2-ethylhexyl)phthalate	0.006	0	0			0	0
2964	Dichloromethane	0.005	0	0			2	2
2041	Dinoseb	0.007	0	0			0	0
2032	Diquat	0.02	0	0			0	0
2033	Endothall	0.1	0	0			0	0
2005	Endrin	0.002	0	0			0	0

State: Rhode Island

Reporting Interval: January 1, 2010 through December 31, 2010

SDWIS Codes		MCL (mg/l)	MCLs		Treatment Techniques		Significant Monitoring/Reporting	
			Number of Violations	Number of Systems With Violations	Number of Violations	Number of Systems With Violations	Number of Violations	Number of Systems With Violations
2992	Ethylbenzene	0.7	0	0			2	2
2946	Ethylene dibromide	0.00005	0	0			0	0
2034	Glyphosate	0.7	0	0			0	0
2065	Heptachlor	0.0004	0	0			0	0
2067	Heptachlor epoxide	0.0002	0	0			0	0
2274	Hexachlorobenzene	0.001	0	0			0	0
2042	Hexachlorocyclo-pentadiene	0.05	0	0			0	0
2010	Lindane	0.0002	0	0			0	0
2015	Methoxychlor	0.04	0	0			0	0
2989	Monochlorobenzene	0.1	0	0			2	2
2968	o-Dichlorobenzene	0.6	0	0			2	2
2969	para-Dichlorobenzene	0.075	0	0			2	2
2383	Total polychlorinated biphenyls (PCB's)	0.0005	0	0			0	0
2326	Pentachlorophenol	0.001	0	0			0	0
2987	Tetrachloroethylene	0.005	0	0			2	2

State: Rhode Island

Reporting Interval: January 1, 2010 through December 31, 2010

SDWIS Codes		MCL (mg/l)	MCLs		Treatment Techniques		Significant Monitoring/Reporting	
			Number of Violations	Number of Systems With Violations	Number of Violations	Number of Systems With Violations	Number of Violations	Number of Systems With Violations
2984	Trichloroethene	0.005	0	0			2	2
2996	Styrene	0.1	0	0			2	2
2991	Toluene	1.0	0	0			2	2
2979	trans-1,2-Dichloroethylene	0.1	0	0			2	2
2955	Xylenes (total)	10	0	0			2	2
2020	Toxaphene	0.003	0	0			0	0
2036	Oxamyl (Vydate)	0.2	0	0			0	0
2040	Picloram	0.5	0	0			0	0
2037	Simazine	0.004	0	0			0	0
2976	Vinyl chloride	0.002	0	0			2	2
	Subtotal		0	0			2 (see notes #2)	2
	Stage 1 Disinfectant Byproducts Rule							
1009	Chlorite	1.0	0	0			0	0
1011	Bromate	0.010	0	0			0	0

State: Rhode Island

Reporting Interval: January 1, 2010 through December 31, 2010

SDWIS Codes		MCL (mg/l)	MCLs		Treatment Techniques		Significant Monitoring/Reporting	
			Number of Violations	Number of Systems With Violations	Number of Violations	Number of Systems With Violations	Number of Violations	Number of Systems With Violations
1006	Chloramines	4.0	0	0			0	0
1008	Chlorine Dioxide	0.8	2	1			0	0
0999	Chlorine	4.0	0	0			0	0
2950	Total Trihalomethanes (Section 7.0 systems)	0.08	0	0			0	0
2456	Total Haloacetic Acids	0.06	0	0			0	0
2920	Total Organic Carbon Removal Ratio	1.0			0	0	0	0
	Subtotal		2	1	0	0	0	0
	Inorganic Contaminants							
1074	Antimony	0.006	0	0			0	0
1005	Arsenic	0.05	0	0			0	0
1094	Asbestos (>10 micrometers)	7 million fibers/L	0	0			0	0
1010	Barium	2.0	0	0			0	0
1075	Beryllium	0.004	3	1			0	0

State: Rhode Island

Reporting Interval: January 1, 2010 through December 31, 2010

SDWIS Codes		MCL (mg/l)	MCLs		Treatment Techniques		Significant Monitoring/Reporting	
			Number of Violations	Number of Systems With Violations	Number of Violations	Number of Systems With Violations	Number of Violations	Number of Systems With Violations
1015	Cadmium	0.005	0	0			0	0
1020	Chromium	0.1	0	0			0	0
1024	Cyanide (as free cyanide)	0.2	0	0			0	0
1025	Fluoride	4.0	0	0			0	0
1035	Mercury	0.002	0	0			0	0
1040	Nitrate	10	1	1			3	3
1041	Nitrite	1	0	0			0	0
1045	Selenium	0.05	0	0			0	0
SM	Sodium						0	0
1085	Thallium	0.002	0	0			0	0
1038	Total nitrate and nitrite	10 (as Nitrogen)	0	0			0	0
	Subtotal		4	2			3	3
	Radionuclide MCLs							
4000	Gross alpha	15 pCi/l	2	1			0	0
4010	Radium-226 and radium-228	5 pCi/l	3	2			0	0

State: Rhode Island

Reporting Interval: January 1, 2010 through December 31, 2010

SDWIS Codes		MCL (mg/l)	MCLs		Treatment Techniques		Significant Monitoring/Reporting	
			Number of Violations	Number of Systems With Violations	Number of Violations	Number of Systems With Violations	Number of Violations	Number of Systems With Violations
4101	Gross beta	4 mrem/yr	0	0			0	0
	Subtotal		5	3			0	0
	Total Coliform Rule							
21	Acute MCL violation	Presence	3	3				
22	Non-acute MCL violation	Presence	52	35				
23,25	Major routine Major repeat						48	42
24,26	Minor routine Minor repeat						15	11
34	Groundwater Rule						13	13
75	Public Education						7	7
	Subtotal		55	38			84	73
	Surface Water Treatment Rule							
36	Monitoring, routine/repeat						0	0

State: Rhode Island

Reporting Interval: January 1, 2010 through December 31, 2010

SDWIS Codes		MCL (mg/l)	MCLs		Treatment Techniques		Significant Monitoring/Reporting	
			Number of Violations	Number of Systems With Violations	Number of Violations	Number of Systems With Violations	Number of Violations	Number of Systems With Violations
41, 43, 44	Treatment techniques				0	0		
	Unfiltered Systems							
31	Monitoring, routine/repeat						0	0
42	Failure to filter				0	0		
	Subtotal				0	0	0	0
	Lead and Copper Rule							
51	Initial lead and copper tap M/R		0	0			0	0
52,56	Follow-up or routine lead and copper tap M/R		0	0			8	7
53	Water Quality Parameters						1	1
57	OCCT/SOWT RECOM./STUDY						0	0
58,62	Treatment Installation				0	0		
65	Public education						0	0
	Subtotal		0	0	0	0	9	8

State: Rhode Island

Reporting Interval: January 1, 2010 through December 31, 2010

SDWIS Codes		MCL (mg/l)	MCLs		Treatment Techniques		Significant Monitoring/Reporting	
			Number of Violations	Number of Systems With Violations	Number of Violations	Number of Systems With Violations	Number of Violations	Number of Systems With Violations
	Consumer Confidence Reports (CCR)							
71	CCR Complete failure to report (Major)						0	0
72	CCR Cont1ent Inadequacy (Minor)						0	0
	Subtotal						4	4
Totals			66	44	0	0	102	90

Notes:

1) Values are in milligrams per liter (mg/l), unless otherwise specified.
2) Monitoring violations for Volatile Organic Compounds are issued as a single violation, not as violations for each of the 21 regulated contaminants.

Definitions for Appendix (Compliance Table)

The following definitions apply to Appendix A (Compliance Table) above.

Filtered Systems: Water systems that have installed filtration treatment [40 CFR 141, Subpart H].

Inorganic Contaminants: Non-carbon-based compounds such as metals, nitrates, and asbestos. These contaminants are naturally-occurring in some water, but can get into water through farming, chemical manufacturing, and other human activities. EPA has established MCLs for 15 inorganic contaminants [40 CFR 141.62].

Lead and Copper Rule: This rule established national limits on lead and copper in drinking water [40 CFR 141.80-91]. Lead and copper corrosion pose various health risks when ingested at any level, and can enter drinking water from household pipes and plumbing fixtures. States report violations of the Lead and Copper Rule in the following six categories:

Initial lead and copper tap M/R: SDWIS Violation Code 51 indicates that a system did not meet initial lead and copper testing requirements, or failed to report the results of those tests to the State.

Follow-up or routine lead and copper tap M/R: SDWIS Violation Code 52 indicates that a system did not meet follow-up or routine lead and copper tap testing requirements, or failed to report the results.

Treatment installation: SDWIS Violation Codes 58 AND 62 indicate a failure to install optimal corrosion control treatment system (58) or source water treatment system (62) which would reduce lead and copper levels in water at the tap. [One number is to be reported for the sum of violations in these two categories].

Public education: SDWIS Violation Code 65 shows that a system did not provide required public education about reducing or avoiding lead intake from water.

Maximum Contaminant Level (MCL): The highest amount of a contaminant that EPA allows in drinking water. MCLs ensure that drinking water does not pose either a short-term or long-term health risk. MCLs are defined in milligrams per liter (parts per million) unless otherwise specified.

Monitoring: EPA specifies which water testing methods the water systems must use, and sets schedules for the frequency of testing. A water system that does not follow EPA's schedule or methodology is in violation [40 CFR 141].

States must report monitoring violations that are significant as determined by the EPA Administrator and in consultation with the States. For purposes of this report, significant monitoring violations are major violations and they occur when no samples are taken or no results are reported during a compliance period. A major monitoring violation for the surface water treatment rule occurs when at least 90% of the required samples are not taken or results are not reported during the compliance period.

Organic Contaminants: Carbon-based compounds, such as industrial solvents and pesticides. These contaminants generally get into water through runoff from cropland or discharge from factories. EPA has set legal limits on 54 organic contaminants that are to be reported [40 CFR 141.61].

Radionuclides: Radioactive particles which can occur naturally in water or result from human activity. EPA has set legal limits on four types of radionuclides: radium-226, radium-228, gross alpha, and beta particle/photon radioactivity [40 CFR 141]. Violations for these contaminants are to be reported using the following three categories:

Gross alpha: SDWIS Contaminant Code 4000 for alpha radiation above MCL of 15 picocuries/liter. Gross alpha includes radium-226 but excludes radon and uranium.

Combined radium-226 and radium-228: SDWIS Contaminant Code 4010 for combined radiation from these two isotopes above MCL of 5 pCi/L.

Gross beta: SDWIS Contaminant Code 4101 for beta particle and photon radioactivity from man-made radionuclides above 4 millirem/year.

Reporting Interval: The reporting interval for violations to be included in the PWS Annual Compliance Report, which is to be submitted to EPA by July 1, 2010, is from January 1, 2010 through December 31, 2010.

SDWIS Code: Specific numeric codes from the Safe Drinking Water Information System (SDWIS) have been assigned to each violation type included in this report. The violations to be reported include exceeding contaminant MCLs, failure to comply with treatment requirements, and failure to meet monitoring and reporting requirements. Four-digit SDWIS Contaminant Codes have also been included in the chart for specific MCL contaminants.

SM: State monitoring requirement for contaminants not regulated under the Safe Drinking Water Act (Sodium)

Surface Water Treatment Rule: The Surface Water Treatment Rule establishes criteria under which water systems supplied by surface water sources, or ground water sources under the direct influence of surface water, must filter and disinfect their water [40 CFR 141, Subpart H]. Violations of the "Surface Water Treatment Rule" are to be reported for the following four categories:

Monitoring, routine/repeat (for filtered systems): SDWIS Violation Code 36 indicates a system's failure to carry out required tests, or to report the results of those tests.

Treatment techniques (for filtered systems): SDWIS Violation Code 41 shows a system's failure to properly treat its water.

Monitoring, routine/repeat (for unfiltered systems): SDWIS Violation Code 31 indicates a system's failure to carry out required water tests, or to report the results of those tests.

Failure to filter (for unfiltered systems): SDWIS Violation Code 42 shows a system's failure to properly treat its water. EPA will supply data for this violation code to the States.

Total Coliform Rule (TCR): The Total Coliform Rule establishes regulations for microbiological contaminants in drinking water. These contaminants can cause short-term health problems. If no samples are collected during the one-month compliance period, a significant monitoring violation occurs. States are to report four categories of violations:

Acute MCL violation: SDWIS Violation Code 21 indicates that the system found fecal coliform or E. coli, potentially harmful bacteria, in its water, thereby violating the rule.

Non-acute MCL violation: SDWIS Violation Code 22 indicates that the system found total coliform in samples of its water at a frequency or at a level that violates the rule. For systems collecting fewer than 40 samples per month, more than one positive sample for total coliform is a violation. For systems collecting 40 or more samples per month, more than 5% of the samples positive for total coliform is a violation.

Major routine and repeat monitoring: SDWIS Violation Codes 23 and 25 show that a system did not perform any monitoring. (One number is to be reported for the sum of violations in these two categories.)

Minor routine and repeat monitoring: SDWIS Violation Codes 24 and 26 show that a system did not did not comply with the required monitoring schedule, by failing to collect the required number of samples. . (One number is to be reported for the sum of violations in these two categories.)

Treatment Techniques: A water disinfection process that EPA requires instead of an MCL for contaminants that laboratories cannot adequately measure. Failure to meet other operational and system requirements under the Surface Water Treatment and the Lead and Copper Rules have also been included in this category of violation for purposes of this report.

Unfiltered Systems: Water systems that do not need to filter their water before disinfecting it because the source is very clean [40 CFR, Subpart H].

Violation: A failure to meet any state or federal drinking water regulation.

PUBLIC
POOLS AND SPAS

COMPLIANCE DATA

In 2010 HEALTH collected and analyzed a total of 1,314samples for bacteria, free residual chlorine, and pH:

Swimming Pool Samples		Therapy Pool Samples		Number of Visits	
Yearly	Seasonal	Yearly	Seasonal	Yearly	Seasonal
646	194	448	26	599	165

Of the 1,314 samples collected the following is a breakdown of the number of violations recorded:

Bacterial Violations				Chlorine Violations			
Swim		Therapy		Swim		Therapy	
Yearly	Seasonal	Yearly	Seasonal	Yearly	Seasonal	Yearly	Seasonal
67	32	49	5	110	53	51	3

pH Violations				Temp. violations	
Swim		Therapy		Therapy	
Yearly	Seasonal	Yearly	Seasonal	Yearly	Seasonal
25	24	22	3	0	0

BOTTLED WATER

COMPLIANCE DATA

In 2010 there were 130 out-of-state bottled water companies and four bottled water facilities located in Rhode Island that were issued permits to distribute their products. The four in-state facilities are:

Crystal Spring Water Company	1259 West Main Road	Middletown
Girard Springs	1100 Mineral Spring Ave.	North Providence
Empire Bottling	61 Buttonwood Street	Bristol
Yacht Club Bottling	2239 Mineral Spring Ave.	North Providence

SAMPLES COLLECTED IN 2010

Raw Water Samples		Product Water Samples		Out of State Products		Site Visits
Bacterial	Chemical	Bacterial	Chemical	Bacterial	Chemical	
108	6	167	6	5	2	136

LEAD AND COPPER

Effect of Partial Lead Service Line Replacement on Total Lead at the Tap

Project summary

As the largest water supplier in Rhode Island, Providence Water Supply Board (ProvWater) provides drinking water to 60% of the state's residents. The system's water has been near or above the US EPA's lead action level of 15 parts per billion (ppb) since the inception of that agency's Lead and Copper Rule in 1991. In 2006, following a change in treatment that was intended to reduce lead solubility, the action level was exceeded; this triggered a requirement for ProvWater to begin a lead service line replacement program.

A lead service line replacement program is required by Section 6.84 of the *Rules and Regulations Pertaining to Public Drinking Water* [R46-13-DWQ]. Specifically, the water system is required to replace that part of lead service lines that the water system owns, which is the segment between the water main and the curb stop. Replacements must proceed at a rate of 7% per year until all are replaced, or until the water system no longer exceeds the Lead Action Level at more than 10% of the sites it samples. The system is also required to offer to replace the property owners' part, from the curb stop into the building, at the owners' expense. In today's housing market, few property owners (1-2%) are choosing to replace the so-called "private side", so most lead service line replacements are partial, or PLSLR.

A study published in 2008 by AwwaRF[1] found that lead service lines contribute up to 75% of the lead in drinking water. In a study published by the CDC in December 2010[1], children in homes with PLSLR and children in homes with intact lead service lines were both found to have an increased chance of elevated blood lead; there was no significant difference between children in homes with an intact lead service line and in homes with a partially replaced one. This lead to some speculation that partial lead service line replacements were not effective at reducing lead exposure through drinking water.

It is understood that a full service line replacement is the ideal, but the issues of ownership of the private side of the line and finding funding sources for the associated cost have not been overcome; meanwhile, the requirement to perform partial replacements is in regulation. The Rhode Island Department of Health (RI HEALTH) wanted to quantify the benefit, or lack thereof, of PLSLR, in terms of total lead delivered to the tap, and the time scale over which the change is seen.

[1] AWWA Research Foundation (2008) Contribution of Service Line and Plumbing Fixtures to Lead and Copper Rule Compliance Issues

[2] CDC (Centers for Disease Control and Prevention) 2010 Association between children's blood lead levels, lead service lines, and water disinfection, Washington, DC, 1998-2006

The RI HEALTH Study

The goal of the study was to quantify the change in both first-draw lead concentration, and the total mass of lead at the tap, following a partial service line replacement. To do this, RI HEALTH recruited eight residents whose homes were scheduled to have a PLSLR during the study period, and took a series of water samples before and after PLSLR.

All of the sites in the study were single-family homes built between 1930 and 1948, and all had mostly threaded brass pipe for their internal plumbing. Where remodeling had been done, segments of brass had been replaced by PVC or soldered copper pipe. None of the sites had whole-house water treatment. Sites were concentrated on three adjacent streets, with one site a half-mile away. Two sites were long-side service (the water main on the opposite side of the street), the other six were short-side (the house on the same side of the street as the water main).

A team from RI HEALTH visited each home before the PLSLR to measure the plumbing (length and diameter, and material) from the water main in the street to the kitchen tap. Notations were made concerning hot water feeds, ice makers, etc. The team scheduled a visit to take a series of samples intended to capture the full volume of water between the main and the tap after a six-hour stagnation. Samples were collected in one-liter Nalgene bottles that had been acid washed by the RI HEALTH lab. Samples were delivered to the lab within 24 hours, and preserved by the lab with acid. Analyses were performed using EPA Method 200.8 within the prescribed holding time.

Following the PLSLR, residents were asked to take a series of sample sets themselves. Each set was to be a one-liter first-draw sample (after six hours stagnation) and a one-liter sample after allowing the water to “run until cold”. This was done three times: 12 hours after the PLSLR, three days after, and two weeks after. After each sampling event, we collected the bottles that day and left fresh bottles. Four months after PLSLR, we re-visited each site and repeated the full sequential sampling process (Table 2).

Pre-PLSLR sequential sampling showed similar patterns in all houses, and though the actual levels were quite variable, all had lead at some point above the action level of 15 parts per billion. An error in calculating the volume of water between main and tap resulted in taking four times the number of one-liter samples than were necessary in the first sequential sampling event. However, this mistake lead to an interesting finding: lead concentrations at all the sites failed to drop off after the entire calculated volumes had been drawn; in some cases, over four times the calculated volume had been collected and lead readings were still above the EPA Action Level of 15 parts per billion. We speculate that this is caused by turbulent flow within the service line and interior plumbing, resulting in mixing fresh water from the main with lead-containing water that had been stagnant in the service line.

The residents’ sampling showed the expected spike immediately following PLSLR. The three-day samples showed a decline in all cases, and by two weeks, levels were at or below the pre-PLSLR readings. After four months, in all cases but one, both first-draw and run-until-cold samples showed a reduction in lead concentration. (The one case, Site #7, demonstrated the long flushing time necessary; the site had very low lead to begin with and showed a significant reduction in total lead overall.) Also, at Site #2, a spike in both lead and copper was observed at sample #16 (eight liters into the system) that is unexplained; a team will re-visit that site to take another full set of samples in the coming weeks.
The follow-up full sequential sampling, four months after PLSLR, showed a large decline in the total mass of lead delivered to the tap (Table 1), as well as a greatly reduced flushing time necessary to move all stagnant lead-containing water out of the internal plumbing. All sites showed both first-draw and flushed samples to be below the action level of 15 parts per billion. It should be noted that six sites out of eight still had at least some samples with concentrations above the action level, probably due to the remaining lead portion of the service line. The average reduction of total mass of lead at the tap (in comparable volumes of water) was 62%, with a low of 36% and a high of 79%. The average mass reduction was 210 micrograms, with a minimum reduction of 41 micrograms and a maximum reduction of 562 micrograms. The two sites with the highest mass of lead, and the longest flushing times, Sites #5 and #8 , showed the most dramatic reduction in both mass and flushing time.

Limitations, conclusions, and suggestions for further study

The first and most obvious limitation of this study is the small sample size. Of the two hundred homes scheduled to have PLSLR during the study period, we were able to recruit eight. The participants were self-selected, but did not appear to have sufficient knowledge concerning plumbing materials, water chemistry, etc. to have a particular bias. Participants appeared to follow instructions concerning sample collection, but this was difficult to verify with certainty; one sample was taken the same evening as the PLSLR and was clearly undrinkable due to the turbidity, as would be expected. Also, instructions for collecting the flushed sample were to “run until cold”, which is imprecise, so introduces an unquantifiable error; there is no way to know if the water collected had been stagnant in the new copper pipe or in the remaining lead portion of the service line, though it was probably both.

High lead levels continuing past the calculated volume of the home’s internal plumbing and service line is important when considering how to collect a good service line sample. In many cases, the peak lead concentration values occurred well beyond the calculated volume. One explanation is that water flow is turbulent, so service line water is mixing with fresh water from the main as it travels through the home’s internal plumbing, thus diluting the highest concentrations and showing lead in a much greater volume of water. This would make it virtually impossible to get a discrete “service line sample” from a tap several feet downstream.

Eight homes may not be a large number, but the results were consistent enough to be compelling. All homes showed a reduction in total lead at the tap. The homes with the highest initial lead levels showed the greatest reduction in both lead and flushing time. The measured reduction of lead in water shows the PLSLR program to have a benefit in terms of reducing exposure, whether flushing advice is followed or not.

RI HEALTH would like to continue this project by returning the homes we have sampled after ProvWater stabilizes its water chemistry. It is expected that the increased carbonate alkalinity that ProvWater is introducing in the near future will reduce lead solubility from all sources, including what is left of the lead service lines at these locations, but we have no firm estimate of how long that process may take.

A larger study would serve to confirm or refine the results we found in Cranston. One suggestion that would not involve trying to coordinate with a partial service line replacement program would be to recruit participants from among homes that have already had partial replacements, and from among homes that have not had partial replacements. A large enough sample group in each category would have to be enlisted to overcome other factors that may affect the outcome, such as total length of line and age and material in internal plumbing. Such a study would result in better advice for how long a tap should be flushed to reduce lead exposure, with or without a partial service line replacement.

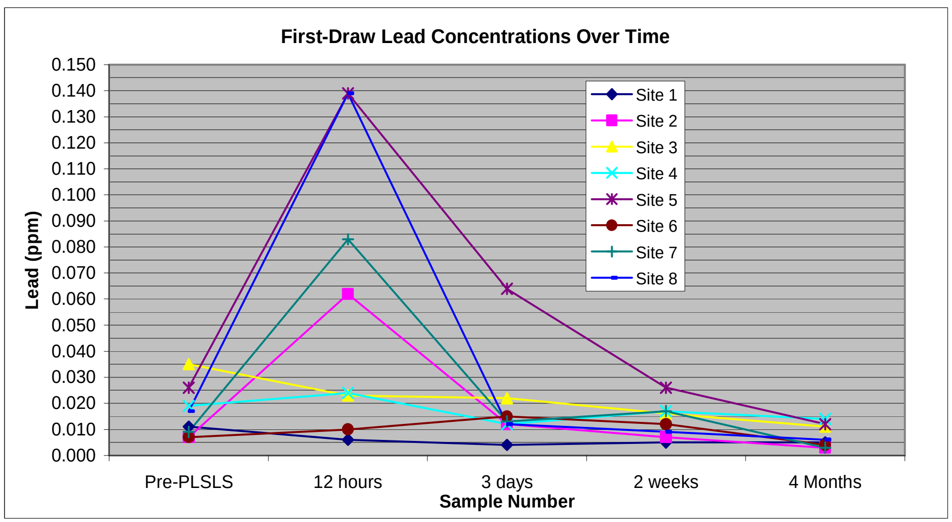
The public health message concerning lead in drinking water has focused largely on flushing, but this study showed a much longer flushing time was necessary to clear the lines of lead bearing water than had previously been assumed. The partial replacements done in the homes studied greatly decreased this flushing time; even after the partial replacement, the volume needed to flush the lines was greater than the calculated volume of the pipes, sometimes more than twice the calculated volume. As EPA considers modifying the language in its public education requirements, this should be considered, and further study done to determine both the cause and the extent of the phenomenon.

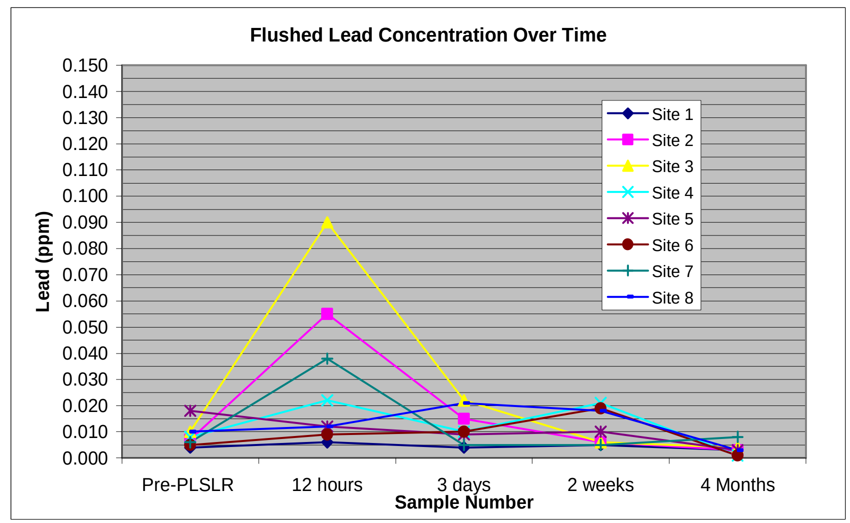
Table 1: Mass reduction in lead in comparable volumes of water after 6-hour stagnations

Site	Pb Mass Before PLSLR (mG)	Pb Mass After PLSLR (mG)	Mass Difference (mG)	Percent Reduction	Notes
Site 1	0.114	0.073	0.041	36%	Least reduction
Site 2	0.297	0.1855	0.112	38%	One anomalous result. Re-sampling scheduled for May.
Site 3	0.381	0.096	0.285	75%	Bottom of hill
Site 4	0.338	0.171	0.167	49%	
Site 5	0.712	0.151	0.561	79%	Bottom of hill; long-side service
Site 6	0.080	0.021	0.059	74%	
Site 7	0.073	0.0195	0.053	73%	Insufficient volume sampled - needs re-sampling
Site 8	0.586	0.187	0.399	68%	Bottom of hill; long-side service
		Average	0.210	62%	

Table 2: First-draw and “run until cold” samples taken after 6-hour stagnations, before and at intervals after PLSLRs (all results in parts per million)

site	PLSLR date	Pre-PLSLS	Pre-PLSLR	first sample date & time	12 hours	12 hours	second sample date & time	3 days	3 days	third sample date & time	2 weeks	2 weeks	4 Months	4 Months	4 Months		
		first draw	run until cold		first draw	run until cold		first draw	run until cold		first draw	run until cold	Date	First Draw	Run Until Cold	net change, first draw	net change, run until cold
1	8/25/2010	0.011	0.004	8/26/2010	0.006	0.006	8/31/2010	0.004	0.004	9/10/2010	0.005	0.005	2/14/2011	0.005	0.003	0.006	0.001
2	9/7/2010	0.007	0.007	9/9/2010	**0.062**	**0.055**	9/10/2010	0.012	0.015	9/21/2010	0.007	0.006		0.003	0.003	0.004	0.004
3	9/9/2010	**0.035**	0.010	9/11/2010	**0.023**	**0.090**	9/13/2010	**0.022**	**0.022**	9/25/2010	**0.016**	0.006		0.011	0.004	0.024	0.006
4	9/15/2010	**0.019**	0.008	9/16/2010	**0.024**	**0.022**	9/18/2010	0.012	0.010	10/1/2010	**0.017**	**0.021**		0.014	0.001	0.005	0.007
5	9/16/2010	**0.026**	**0.018**	9/18/2010	**0.139**	0.012	9/20/2010	**0.064**	0.009	10/1/2010	**0.026**	0.010		0.012	0.003	0.014	0.015
6	9/22/2010	0.007	0.005	9/23/2010	0.010	0.009	9/24/2010	0.015	0.010	10/6/2010	0.012	**0.019**		0.004	0.001	0.003	0.004
7	9/23/2010	0.009	0.006	9/24/2010	**0.083**	**0.038**	9/27/2010	0.013	0.005	10/7/2010	**0.017**	0.005		0.003	0.008	0.006	-0.002
8	9/29/2010	**0.017**	0.010	9/30/2010	**0.139**	0.012	10/3/2010	0.012	**0.021**	10/14/2010	0.009	**0.018**		0.006	0.003	0.011	0.007



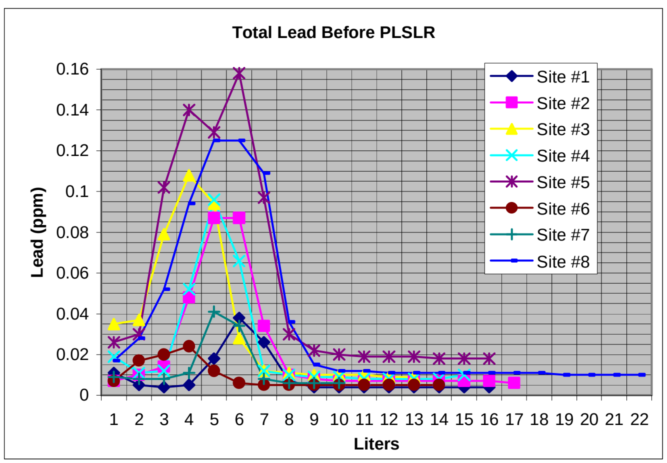


Pre-PLSLR and 4-month "Flushed" values were the lowest levels at which lead stabilized during sequential sampling. Other values were the results of samples taken by residents. Instructions were to "run water until cold", so some variability in location of water sample in pipe is to be expected and is unquantifiable.

Table 3: Sequential sampling results before, and 4 months after, PLSLR

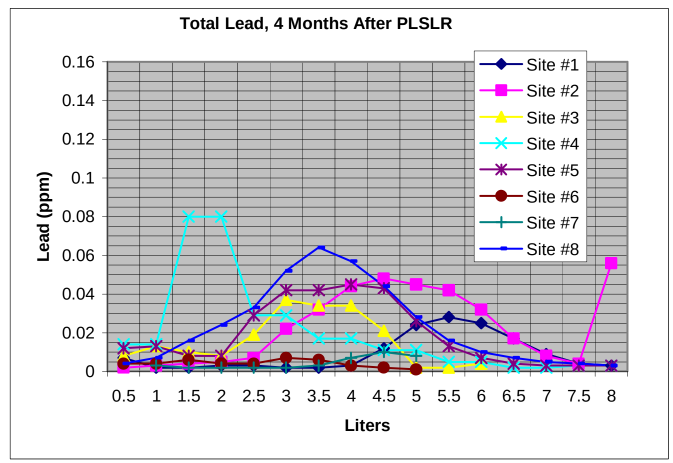
Sequential Sampling Results, Auburn neighborhood, Summer 2010
all results in parts per million

Liter #	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8
Year Built:	1937	1932	1940	1927	1940	1920	1920	1920
1	0.011	0.007	**0.035**	**0.019**	**0.026**	0.007	0.009	**0.017**
2	0.005	0.01	**0.037**	0.011	**0.030**	**0.017**	0.008	**0.028**
3	0.004	0.014	**0.079**	0.012	**0.102**	**0.020**	0.008	**0.052**
4	0.005	**0.048**	**0.108**	**0.052**	**0.140**	**0.024**	0.011	**0.094**
5	**0.018**	**0.087**	**0.094**	**0.096**	**0.129**	0.012	**0.041**	**0.125**
6	**0.038**	**0.087**	**0.028**	**0.066**	**0.158**	0.006	**0.034**	**0.125**
7	**0.026**	**0.034**	0.012	0.012	**0.097**	0.005	0.008	**0.109**
8	0.007	0.01	0.011	0.010	**0.030**	0.005	0.006	**0.036**
9	0.004	0.008	0.010	0.009	**0.022**	0.005	0.006	0.015
10	0.004	0.007	0.010	0.009	**0.020**	0.005	0.006	0.012
11	0.004	0.007	0.010	0.008	**0.019**	0.005		0.012
12	0.004	0.007	0.009	0.008	**0.019**	0.005		0.011
13	0.004	0.007	0.009	0.008	**0.019**	0.005		0.011
14	0.004	0.007		0.008	**0.018**	0.005		0.011
15	0.004	0.007		0.010	**0.018**			0.011
16	0.004	0.007			**0.018**			0.011
17		0.006						0.011
18								0.011
19								0.01
20								0.01
21								0.01
22								0.01



Sequential Sampling Results, Auburn neighborhood, Winter 2011
(500 mL samples, except Site #4)

Liter #	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8
0.5	0.007	0.002	0.008	0.014	0.012	0.004		0.004
1	0.002	0.003	0.013	0.014	0.013	0.004	0.003	0.007
1.5	0.002	0.004	0.010	**0.080**	0.008	0.006	0.002	**0.016**
2	0.003	0.005	0.008	**0.080**	0.008	0.004	0.002	**0.024**
2.5	0.003	0.007	**0.019**	**0.029**	**0.029**	0.004	0.002	**0.033**
3	0.002	**0.022**	**0.037**	**0.029**	**0.042**	0.007	0.002	**0.052**
3.5	0.002	**0.032**	**0.034**	**0.017**	**0.042**	0.006	0.003	**0.064**
4	0.003	**0.044**	**0.034**	**0.017**	**0.045**	0.003	0.007	**0.057**
4.5	0.012	**0.048**	**0.021**	0.011	**0.043**	0.002	0.010	**0.044**
5	**0.024**	**0.045**	0.002	0.011	**0.026**	0.001	0.008	**0.028**
5.5	**0.028**	**0.042**	0.002	0.005	0.013			**0.016**
6	**0.025**	**0.032**	0.004	0.005	0.007			0.01
6.5	**0.017**	**0.017**		0.002	0.004			0.007
7	0.009	0.008		0.002	0.003			0.005
7.5	0.004	0.004		0.003	0.003			0.004
8	0.003	**0.056**		0.003	0.003			0.003



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